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Lyons

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(54) **GEOGRAPHICALLY ADAPTIVE PORTABLE BROADCAST RECEIVER**

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(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(52) **U.S. Cl.** **455/186.1**; 455/161.2; 455/166.1; 455/185.1; 455/558

(58) **Field of Search** 455/150.1, 160.1, 455/161.1, 161.2, 161.3, 166.1, 166.2, 179.1, 181.1, 185.1, 186.1, 186.2, 45, 558, 345, 418–420, 456, 556–559; 709/217–219

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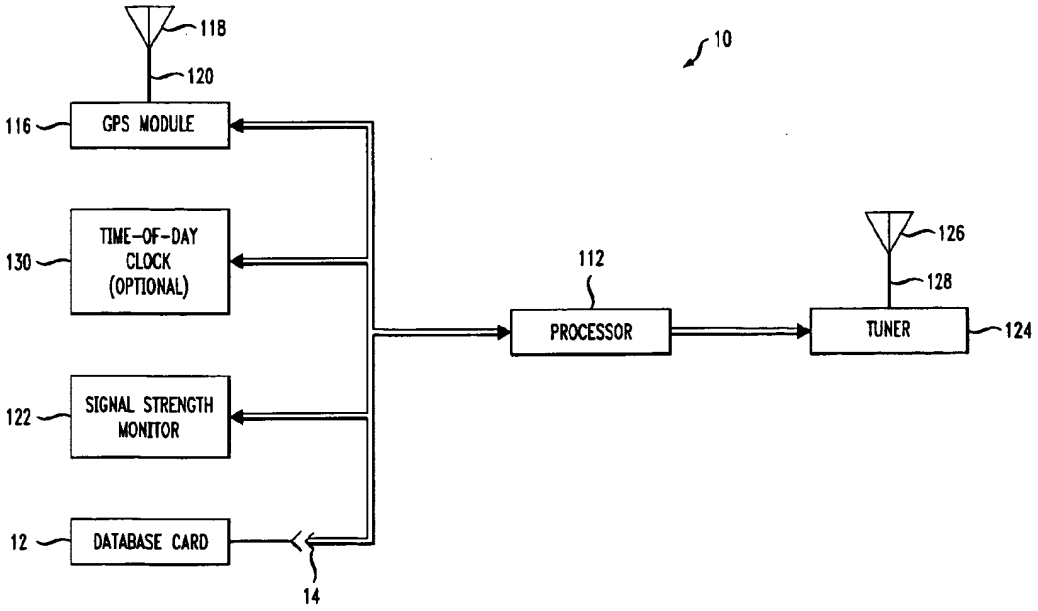
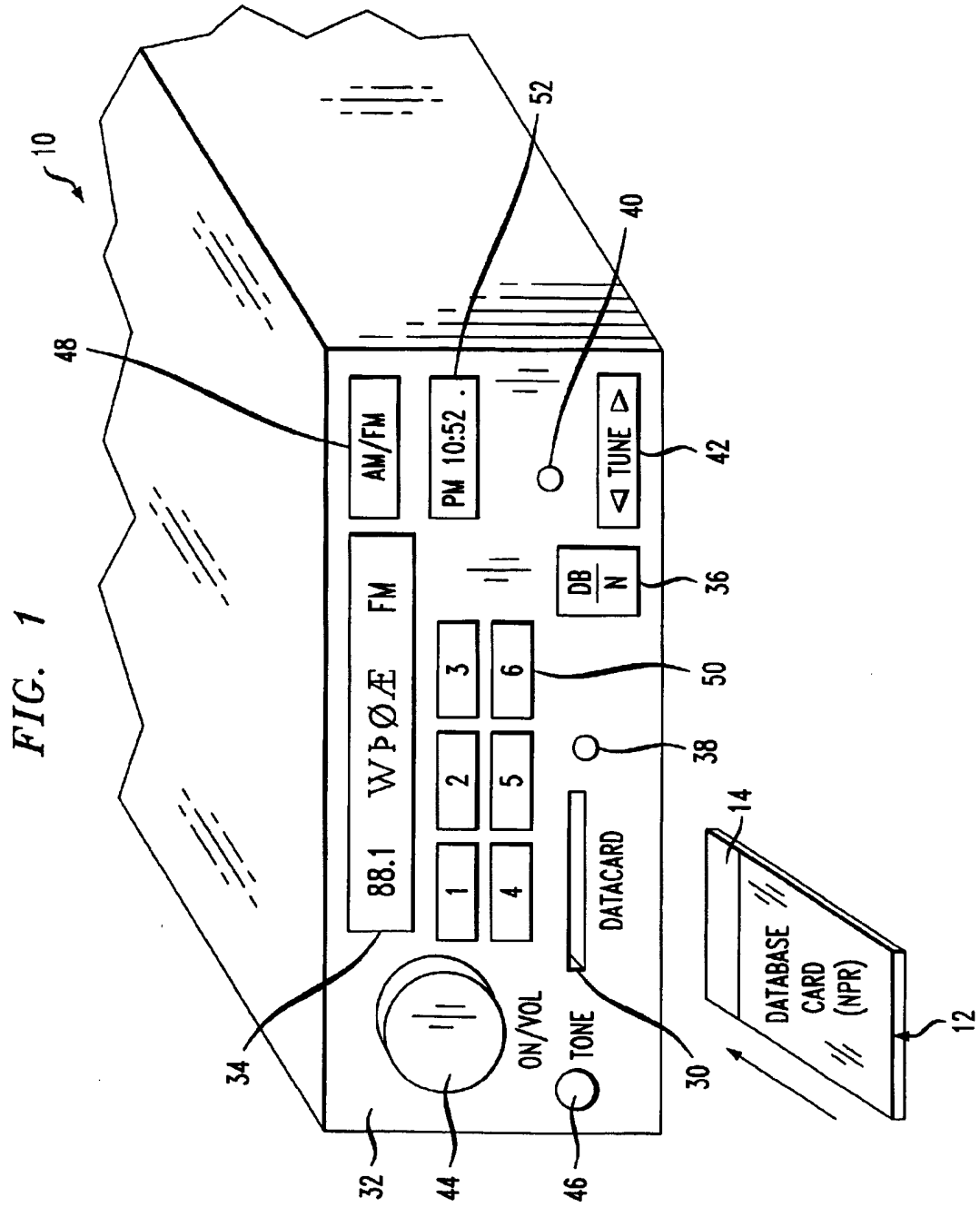
(57) **ABSTRACT**

A broadcast receiver that responds to broadcast stations having a listener-preferred program style. The receiver has a processor and a database memory arranged to be coupled with the processor. The memory is configured to store information concerning a number of broadcast stations that serve at least a portion of a user-designated geographic area, and which stations have a designated program style. The information corresponds to an operating frequency for each broadcast station and an associated service coverage. A geographic position determining unit (e.g., a GPS receiver) is coupled to the processor and produces information corresponding to a current position of the receiver within the designated area. The processor is configured to produce a tuning signal operative to set a tuner unit to respond to a broadcast station that can be received at the receiver's position with the designated program style.

6 Claims, 3 Drawing Sheets

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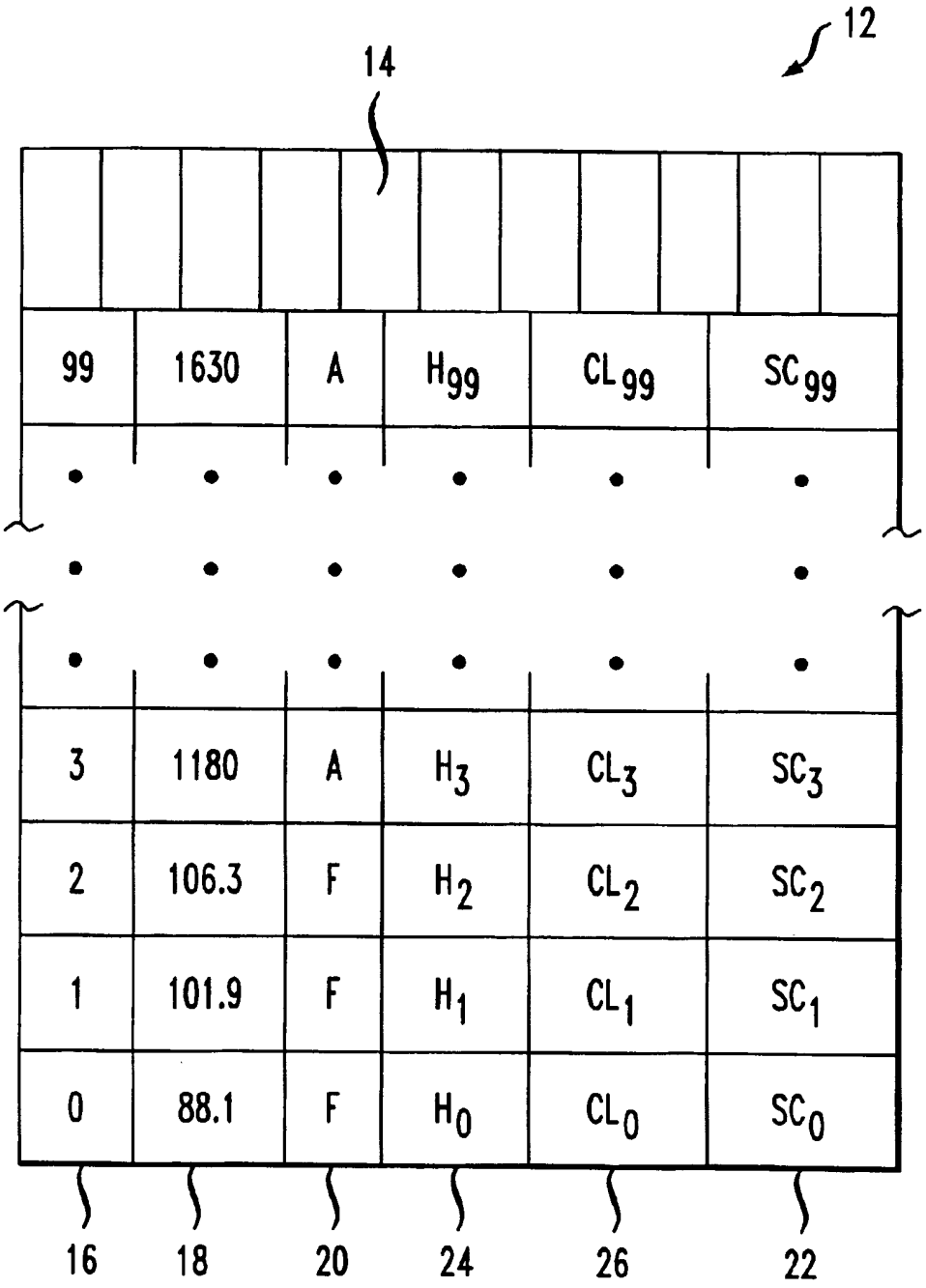
52
40
48
AM/FM
PM 10:52
TUNE
42
88.1 WPØÆ FM
DB/N
36
3
6
50
2
5
38
1
4
DATACARD
14
ON/VOL
TONE
DATABASE CARD (NPR)
12
34
30
32
44
46

FIG. 1

FIG. 2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H_1
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18
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24
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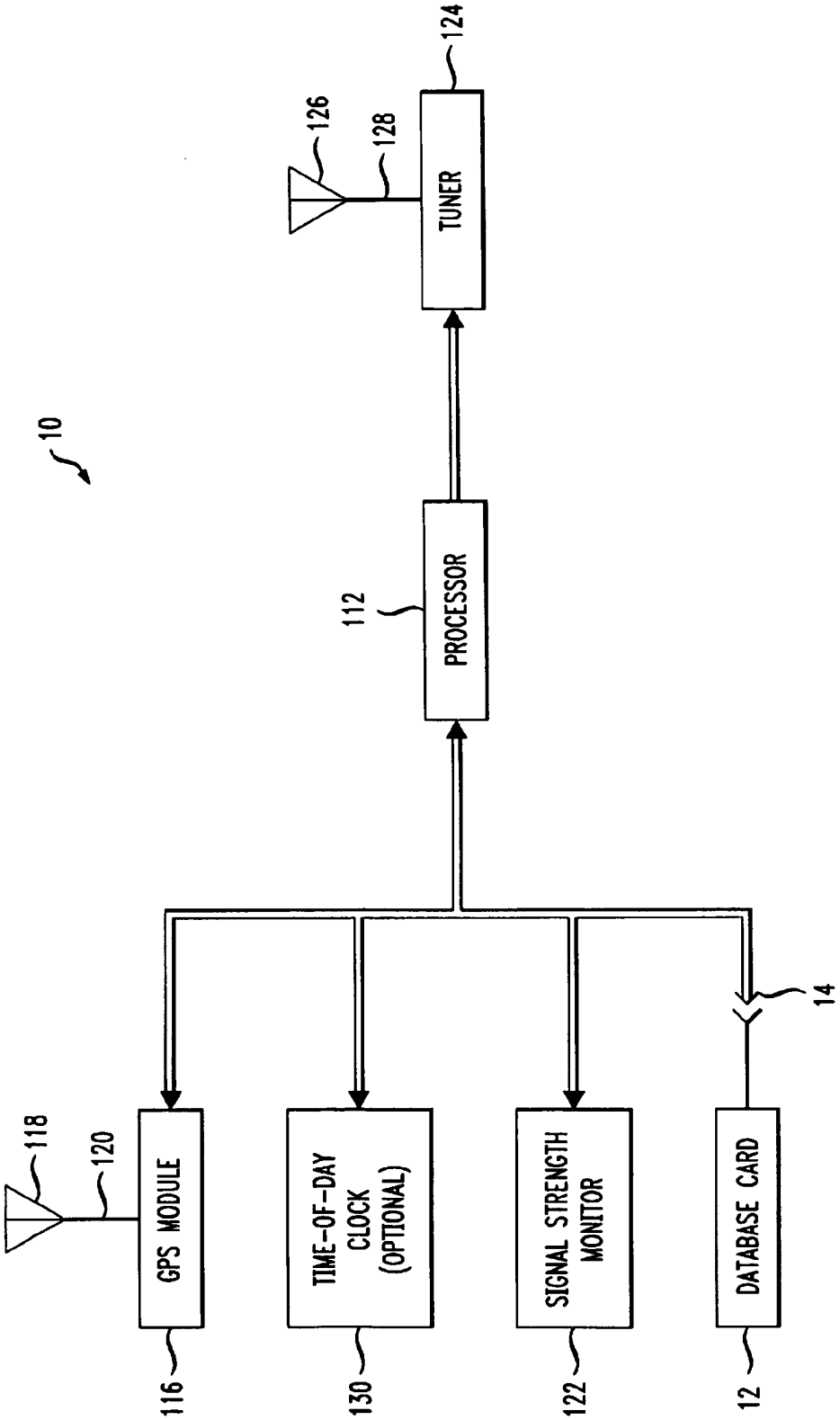
FIG. 3


10
124
126
128
TUNER
112
PROCESSOR
14
118
120
GPS MODULE
TIME-OF-DAY CLOCK (OPTIONAL)
SIGNAL STRENGTH MONITOR
DATABASE CARD
116
130
122
12

GEOGRAPHICALLY ADAPTIVE PORTABLE BROADCAST RECEIVER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to broadcast receivers. In particular, the invention concerns a receiver arranged to respond selectively to broadcast stations with a desired program content regardless of the receiver's geographic location or position.

2. Discussion of the Known Art

Contemporary broadcast stations are driven by demographic analyses, and thus focus on particular kinds of program content to capture the stations' target audiences. That is, radio listeners tend to listen for a particular kind or "type" of broadcast station that best serves their personal listening preferences. Various types of radio program content are readily identifiable upon listening to most stations. For example; jazz, rock, R & B, news, country, talk, and the like.

A typical commercial AM or FM radio broadcast signal has an effective coverage radius of from about 30 to 60 miles. Most persons routinely travel distances that exceed the range of any one broadcast station; for example, when commuting, traveling on vacation, or as part of their jobs. Thus, as persons move from one broadcast area (market) to another, they must search manually for a station that is in range and has their preferred program style. When on vacation or taking other long excursions, persons usually have no knowledge of the broadcast programming available along a given route, and, thus, cannot readily find a station suited to their needs.

A Radio Data System (RDS) service was adopted in the United States in 1993. RDS applies only to VHF-FM broadcast stations, however. The service allows an FM station to encode a signal corresponding to a program type (PTY code) on a sub-carrier of the station's broadcast signal. Specially equipped FM-RDS receivers can operate to respond only to stations transmitting a desired program type code in response to button entries by a listener. Relatively few FM-RDS receivers have been put to use since adoption of the service in the United States. As a result, FM broadcast stations that encode RDS data on their signals also remain few in number.

Software known as "ID Logic" has been offered for use with broadcast receivers. As advertised, ID Logic equipped receivers use an "in-receiver database" of over 40,000 broadcast stations, with various different program types and other information stored for the stations.

SUMMARY OF THE INVENTION

According to the invention, a broadcast receiver for responding to broadcast stations having a listener-preferred program style, includes a processor arranged to control operations of the receiver, and a database memory arranged to be coupled to the processor. The memory is configured to store information concerning a determined number of broadcast stations each of which serves at least a portion of a user-designated geographic area, and which stations broadcast a designated program style. The stored information corresponds to an operating frequency for each broadcast station and an associated service coverage. A geographic position determining unit is coupled to the processor, and the unit is arranged to produce information corresponding to a current position of the receiver within the user-designated area. The processor is configured to produce a tuning signal operative to set a tuner unit to respond to a broadcast station that can be received at the position of the receiver with the designated program style, according to information stored in the database memory and current position information from the position determining unit.

For a better understanding of the invention, reference is made to the following description taken in conjunction with the accompanying drawing and the appended claims.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. **1** is a view of a front portion of a broadcast receiver and a database memory card according to the invention;

FIG. **2** is a memory map for the database memory card in FIG. **1**; and

FIG. **3** is a schematic block diagram of a broadcast receiver according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** shows a front portion of a broadcast receiver **10** with a separate, insertable and removable database memory card **12**, according to the invention. It will be understood from the following description that instead of using a detachably connectable memory card, the receiver **10** can operate with an internal database memory for storing information of the kind stored in the card **12**, provided the information can be downloaded to the database memory by a connector or equivalent means (not shown) on the receiver **10**.

The memory card **12** may be in the form of a commercially available programmable memory card having a connecting terminal section **14** at a leading edge of the card. Specifically, the card **12** may be a flash memory or an electronically erasable programmable read-only-memory (E^2PROM) having enough memory capacity to store information concerning a determined number of broadcast stations that serve at least a portion of a user-designated geographic area, and which have a program style that suits a designated user preference. Information corresponding to each station's operating or carrier frequency and an associated service coverage area, is stored by the card **12**.

FIG. **2** is an example of a memory map for the database memory card **12**. The map may also apply to the mentioned alternate, internal database memory. In FIG. **2**, information concerning a number of AM or FM broadcast stations, or both, is loaded at corresponding memory addresses **16**. For example, the stations may be ones that can be received adequately at certain locations along an automobile route that a listener is planning to drive between two specified cities. Further, all of the stations broadcast a user's preferred program type, e.g., jazz music, during at least some hours on given days. Each memory address **16** has associated frequency data **18** corresponding to the station's operating or carrier frequency, modulation data **20** to identify whether the station is frequency modulated (F) or amplitude modulated (A), station service coverage data **22** defining the station's geographic scope of listener coverage in terms of, e.g., global latitude and longitude information; time data **24** corresponding to the hours (and, optionally, specific days) during which the station broadcasts the preferred program style, and call-letter data **26** identifying the station's call sign.

All of the data loaded in the database memory card **12** is obtained, for example, from a master database of broadcast

stations that includes each station's geographic service coverage and its broadcast program style. It will be understood that such a master database can be made accessible to users by, e.g., an Internet web site or a direct dial-up telephone connection.

Using a commercially available memory card interface and a personal computer having a telephone modem (not shown), the user enters information designating a program style preference, and a geographic area such as a specified travel route between two cities. An application program resident in the user's own computer, or at a server of the master database, selects from the database only those stations whose service coverage at least partly overlaps the user's specified travel route. Data associated with the selected stations is then downloaded to the user, so that his/her memory card **12** is loaded or updated via the memory card interface. The user's card **12** is then ready to be inserted in a "datacard" slot **30** in a front panel **32** of the receiver **10** in FIG. **1**. Details of the mentioned application program and memory card interface can be determined by persons skilled in the art in view of the present disclosure.

As shown in FIG. **1**, the receiver **10** also has a display **34** to show the carrier frequency of a broadcast station to which the receiver **10** is tuned. If the receiver **10** is in a database operating mode, the display **34** can show any of the data stored in the memory card **12**, for example, the station's call sign and modulation, in addition to its carrier frequency. To allow the receiver **10** to be switched between the database operating mode and a normal one, a mode switch **36** is accessible on the front panel **32**. When switched to the database mode, an indicator lamp **38** next to the datacard slot **30** is illuminated. When in the normal mode, lamp **38** is extinguished and another lamp **40** is illuminated over a tuning control bar **42**.

Other controls provided on the receiver panel **32** are those found on conventional receivers, e.g., an ON/OFF volume control **44**, tone adjust **46**, AM/FM band select button **48**, station pre-set buttons **50**, and a time clock **52**. The receiver **10** may be in the form of an automobile radio for mounting in a dashboard, or a portable or desktop radio that the user may physically transport from one location to another.

FIG. **3** is a block diagram of the broadcast receiver **10** according to the invention. The receiver **10** includes a processor **112** that controls other operating components of the receiver, and the timing and sequence of operations carried out by these components. For example, the processor **112** may be a commercially available integrated circuit (IC) chip, or it may be an application specific one (ASIC). Processor **112** has an associated read only memory (ROM) that stores one or more operating programs enabling the processor to carry out its functions, and one or more random access memories (RAMs) for storing ongoing operating data. Processor **112** also has associated input and output (IO) stages enabling data to be exchanged between the processor and those components under its control, as is known in the art.

The database memory card **12** is coupled to the processor **112** via a pin connector **114** when the card is inserted in the slot **30** in the receiver **10**. As mentioned, an alternate, internal database memory may instead be "hard-wired" with the processor **112**. Such an internal memory would have an associated cable connector or equivalent means such as an infra-red (IR) receiver, to allow data to be entered into the memory from an outside data terminal or modem using a known data transmission protocol.

A conventional position determining unit **116** is also coupled with the receiver processor **112**. The unit **116** may comprise a commercially available global positioning system (GPS) receiver, such as, e.g., a GT Plus Oncore (TM) GPS receiver available from Motorola, Inc., Northbrook, Ill. An antenna module **118** associated with the unit **116** is located remote from the unit **116** for adequate reception through a coaxial cable **120**. The unit operates to produce information corresponding to a current position of the receiver **10** within the geographic area designated by the user. Such information typically comprises data corresponding to a global latitude and longitude.

A receive signal strength (RSS) monitor stage **122** is configured to measure a relative signal strength of each station to which the receiver **10** is tuned. Data corresponding to signal strength is reported from the stage **122** to the processor **112** at set intervals. The RSS stage **122** is also of conventional configuration.

A receiver tuner unit **124** is constructed and arranged to be set to respond to a broadcast station signal at a carrier frequency that corresponds to a tuner signal output from the processor **112**. In the present embodiment, unit **124** comprises an AM and an FM tuner. The tuning signal from processor **112** thus serves to select either the AM or the FM tuner, and to set the selected tuner to respond to a carrier signal whose frequency is obtained from selected frequency data stored by the card **12**. For example, the tuning signal sets a voltage that is applied to a varactor tuning diode in the unit **124**. A suitable AM/FM antenna **126** is connected to the unit **124** by a coaxial cable **128**. The manner by which the receiver **10** selects the stored frequency data for setting the tuning unit **124**, is explained below.

Receiver **10** may also have a time of day and date clock **130** coupled with the processor **112**. If the database memory card **12** has stored data indicating a time of day (and date) on which a certain station broadcasts the designated program type, such data is compared by the processor **112** with current time information supplied by the clock **130** to determine if the station is currently available for listening by the user.

When in the database operating mode, the receiver **10** operates as follows. The position determining unit **116** periodically sends data concerning the receiver's current position to the processor **112**. Thus, if the radio is in a moving vehicle, position data output from unit **116** will vary accordingly. The processor **112** compares current position data from the unit **116**, with all of the station service coverage data **22** stored at the memory addresses **16** in the card **12**. Those addresses having service coverage data **22** that coincides with the receiver's present position, and having time data **24** that coincides with current time data from the clock **130** (if provided), are identified as representing potential broadcast frequencies to which the receiver can be tuned to receive the user's designated program style. Frequency data **18** at each of the identified addresses **16** is read from the card **12** and processed to produce a sequence of corresponding tuning signals from the processor **112**.

While the tuner unit **116** is set to respond to station signals at each potential frequency in response to the mentioned sequence of tuning signals, a relative signal strength measurement is performed by the RSS unit **122**. The processor **112** is programmed and configured to determine which of the RSS measurements is optimal (e.g., the strongest), and then outputs a steady tuning signal which sets the tuner unit to respond to the optimally measured broadcast signal over a given listening period. Typically, the processor **112** is also programmed so that at the end of a listening period, the processor re-evaluates the receiver's current position and

scans all potential frequencies. Thus, the receiver **10** always responds to an optimal broadcast station serving the receiver's location with the designated program style, regardless of the receiver's position within the user-designated geographic area. In addition, such re-evaluations may be initiated when desired by the user if, for example, a "re-tune" button operative to send a re-evaluation command to the processor is provided on the receiver panel **32**.

While the foregoing description represents a preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made, without departing from the spirit and scope of the invention pointed out by the following claims.

I claim:

1. A broadcast receiver for responding to broadcast stations having a listener-preferred program style, comprising:

a processor arranged to control operations of the receiver;

a database memory arranged to be coupled to the processor, wherein said memory is in the form of a memory card with a connecting terminal section and is configured to store information concerning a number of broadcast stations having a pre-defined program style and situated over a pre-defined geographic area, said information corresponding to an operating frequency for each broadcast station, the station's service coverage within the pre-defined geographic area, and times during which the station broadcasts the pre-defined program style;

the memory card has an associated interface arranged for coupling with a database and configured so that a listener can download from the database into the memory card said information concerning only the broadcast stations having said pre-defined program style and situated over said pre-defined geographic area;

an electrical card connector coupled to the processor, wherein the connecting terminal section of the memory card is arranged to engage said card connector;

a geographic position determining unit coupled to said processor, said unit being constructed and arranged to produce information corresponding to a current position of the receiver within the designated geographic area; and

a tuner unit coupled to the processor;

wherein said processor is configured to produce a tuning signal operative to set the tuner unit to respond to a broadcast station having the pre-defined program style and which station can be received at the position of the receiver, in accordance with the information downloaded into the memory card by the listener, and the information from the position determining unit.

2. A broadcast receiver according to claim **1**, wherein said geographic position determining unit comprises a global positioning system (GPS) receiver.

3. A broadcast receiver according to claim **1**, wherein said memory card comprises a programmable read-only-memory.

4. A broadcast receiver according to claim **1**, including a receive signal strength (RSS) monitor stage coupled to the processor and configured to measure a relative signal strength of a station to which the tuner unit is set to respond by said tuning signal.

5. A broadcast receiver according to claim **4**, wherein said processor is configured to produce a sequence tuning signals corresponding to frequency data read from a number of identified addresses of the memory card.

6. A broadcast receiver according to claim **5**, wherein said processor is programmed to determine which of a number of RSS measurements performed by the RSS monitor stage during said sequence of tuning signals is strongest.

* * * * *